

Assignment 3

1. A supermarket has two checkout stations, regular and express. Customers arrival according to arrival process, but regular and express customers have two different interarrival time distributions. An arriving regular customer that finds a regular server available starts service immediately on the regular server. If she finds the regular server busy but the express server available, she will start service with the express server. If both are busy, she waits in the queue for the regular server. Likewise, an arriving express customer will start service at the express server, if possible, and at the regular server if the express server is busy but the regular server is available, waiting in the express queue if both are busy. Both queues are first-in first-out.

The service times for regular and express customers are different, but don't depend on which server is processing them. So the distribution of a service time for a regular customer is the same regardless of which server he is being served by, and likewise for an express customer.

When a server finishes serving a customer, she starts serving the next customer in their queue. If their queue is empty, the server starts serving the next customer in the other queue. So if a regular server finishes service, if there is someone in the regular queue, the next in the regular queue will start service. If nobody is in the regular queue but there is somebody in the express queue, the next express customer will start service at the regular server.

Formulate this situation as an Event Graph. Your model should be capable of estimating the proportion of time each server is busy and the time-average number in each queue. Your model does not have to be able to directly estimate the mean time in the system or the queue.

2. In a quarry, trucks deliver ore from m shovels to a single crusher. Trucks are assigned to a specific shovel, so that a truck will return to its assigned shovel after dumping its load at the crusher. Two different truck sizes are used, large and small. The times to load a truck at the shovel and to dump it at the crusher are random, and each size truck has a different distribution of load times and dump times. The times to travel from the crusher to a shovel are random and different for each truck size, as are the times to travel from the shovel to the crusher.

The shovel queues are first-in first-out, but the crusher queue is ordered in decreasing size. That is, all large trucks in the crusher queue must be dumped before any small trucks are dumped at the crusher.

Assume each shovel is assigned s small trucks and l large trucks and at the start of the simulation all trucks are at their assigned shovel, with the large trucks ahead of the small trucks.

Formulate an Event Graph model that is capable of estimating the utilization of the shovels and the crusher and the time-averaged mean number in queue for each shovel and the crusher.